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ABSTRACT

The theory of individual preferential choice is a descriptive theory for the resolution of conflict within the individual. If there is only a single peaked preference function, it is relatively easy to find the preference. Under a multipeaked preference function, an optimal choice can be insured only after an exhaustive, costly search. Therefore, a set of conditions must be found to insure that a preference function will be single peaked. The first of these conditions is to recognize that options are composed of elemental components and that there are only two kinds: either more is better or more is worse. Their respective utility functions have positive slope and negative slope and are concave down. This concavity is supported by two psychological principles: that good things satiate and bad things escalate. A second condition is to screen available options by deleting those that are dominated; each option that survives either has more yield or less risk than any other. The individual recognizes that by giving up a little yield, a lot of risk can be avoided, or by taking a little more risk, a lot more yield can be obtained. In transferring this theory to social conflict, status quo equals zero for both parties. This is supported by two psychological principles: individuals, regardless of how they may assess their status quo, are motivated to improve on it and to avoid worsening it. There are three types of social conflict: (1) the two opposing functions occur within a single person; (2) the two opposing functions occur because two people want different things and must settle for the same thing; and (3) the the two opposing functions occur because two people want the same thing and must settle for a different thing. The process of resolving the third type of conflict is one of a sequence of unilateral actions and reactions to determine a winner, in contrast to the second type of conflict, which involves a search for a mutually acceptable outcome. In general, transforming the third type of conflict down into one of the others tends to make t he conflict easier to resolve in the sense of choosing an option, but requires power to impose the solution on the belligerents. (AA)

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From Preference Theory to Social Conflict: The Stucture of Conflict

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I am going to review today some ideas we have been developing about the structure of conflict. Let me say in beginning that I am not trying to produce a recipe for resolving or curing the world's many conflicts -- although I do believe - and believe strongly -- that significant steps can be taken on this important path when we understand more fully the structure and characteristics of conflict, and the structure and characteristics of options that permit and encourage its resolution. I like to think of this structure of conflict as similar to anatomy in medicine. Anatomy doesn't in itself cure anything, but it is basic, necessary information, and the practicing physician is the better for it.

I shall begin by summarizing a theory of individual preferential choice that, we will see, is a descriptive theory for the resolution of conflict within the individual. We will then spend most of the time on the extension of that theory to conflict between individuals, i.e., social conflict.

Preference Theory

To build a desciptive theory of individual preferential choice the first concern was: What are the empirical invariances to be explained?

Consider an ordinal scale of options, for example:
a set of attitude statements from pro to con, or
the amount of sugar you like in your coffee, or
the speed you drive on the highway, or
the temperature you like your shower, or
the number of children you'd like to have, or
the length of time you take for a vacation abroad,
etc.

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Commonly, one of the options is most preferred, we call it the ideal, and preference falls off in both directions from that point.

This characteristic was first described by Joseph Priestley in 1775 (Priestley,1775), and is pictured in Wundt's Principles of Physiological Psychology a hundred years later, which was about a hundred years ago (Wundt,1874). Preference, identified with pleasantness and unpleasantness and called hedonic tone in the old days, was much studied but never understood or explained (Beebe-Center,1932/1966). The shape of the preference function described by Priestley and Wundt was simply accepted as a primitive.

Nowadays we describe this phenomenon with a single peaked preference function, exemplified in Fig.1.

[Insert Fig.1 about here]

We do not always have such a preference function, but are lucky when we do because it is comparatively easy, then, to find the best choice, as illustrated by Fig.2.

[Insert Fig.2 about here]

Starting with any option, if search proceeds in one direction preference decreases and in the other direction preference increases. It is easy for a search process to converge on the optimum choice.

If the function were multipeaked the search could be trapped in a local maximum or get into a divergent sequence, both of which are illustrated in Fig.3.

[Insert Fig.3 about here]

Under a multipeaked preference function an optimal choice could only be insured with an exhaustive search, which can be stressful, more costly than its worth, or even impossible.

So we ask, what set of conditions will insure that a preference function will be single peaked? When I say we this is not a rhetorical we but refers also to my collaborator, George Ayrunin, a Professor of Mathematics at the University of Massachusetts.

Our first condition is that options are composed of elemental components and that there are only two kinds: either more is better or more is worse. Their respective utility functions, illustrated in Fig.4, have positive slope and negative slope, and are concave down.

[Insert Fig.4 about here]

We call these utility functions for elemental components proper utility functions; and we propose that their concavity is supported by two psychological

principles: that good things satiate and bad things escalate.

Consider foreign travel: initially there are many new sights and exotic foods, but as time goes on the novelty wears off, good things satiate. At the same time costs are increasing, affairs at home, business and professional, are being neglected, and these bad things are escalating.

When we drive a car, the time to get to our destination, the risk of driving fast, the wear and tear on the car, all effect the speed at which we choose to drive. We don't know that these are elemental components but if they are not, they are themselves constituted of elemental components and are mediating the speed at which we choose to drive. Risk, for example, is both exilarating and threatening. Increasing speed satiates one and escalates the other.

Incidentally, the shape of these proper utility functions implies that a little good goes a long way and a lot doesn't go much further. A little evil doesn't do much harm but a lot can be very serious.

The individual's total preference is an aggregation of these elemental utility functions according to some rule, for example, additivity. If the combination rule satisfies certain stringent conditions we call it a proper preference function, and addition is a good example of a proper preference function.

Mathematical analysis reveals that proper utility functions and proper preference functions are not enough to insure that the preference function will be single peaked. We find that we need a condition on the structure of the options, and we call this condition an efficient set. It is illustrated in Fig.5.

[Insert Fig.5 about here]

In an efficient set, the options are ordered, and as we go from one option to the next some components get better and some get worse. To be an efficient set, as the good gets better, the bad must get worse faster. This relationship must hold between successive pairs of options.

It is easy to show that if the individual has proper utility functions and a proper preference function then an efficient set is both necessary and sufficient to insure that the preference function is single peaked (Coombs and Avrunin, 1977a, 1977b)

Now this last condition, that the options constitute an efficient set, does not occur naturally in most real world

decision problems. For example, consider the stock market, and suppose, for purposes of illustration, that only yield and risk were the relevant aspects. Here we refer to Fig.6.

[Insert Fig.6 about here]

As we proceed from one option to another they don't necessarily get riskier when the yield increases, so the options are not ordered, and that violates one of the requirements for an efficient set. An individual can do something about this, however, if he or she exercises a modest amount of rationality. If one option is at least as good as another in all respects and better in at least one then it dominates the other. So let us introduce another psychological principle, that dominated options are neglected.

If the individual screens the available options by deleting those that are dominated, the options that survive we call Pareto Optimal. Each option that survives either has more yield or has less risk than any other. However the set is not necessarily efficient. Why this may be, is illustrated by Fig.7.

[Insert Fig.7 about here]

The options labelled a,b, and c, are Pareto Optimal, each is better in some respect than any other. Furthermore, in any two-dimensional case they are totally ordered, as we see. In comparing b with a (Fig.7) the individual sees that by giving up a little yield a lot of risk can be avoided; in comparing b with c the individual sees that by taking a little more risk, a lot more yield can be obtained. So the individual is driven from b toward a by fear and from b toward c by greed.

It is possible, then, for an individual with proper utility functions and a proper preference function to prefer a to b and also to prefer c to b, and that violates single peakedness, as is illustrated by Fig. 8.

[Insert Fig.8 about here]

We see that over the set of options, abc, which are Pareto Optimal and totally ordered, the preference function is dipped; the individual is pulled in diametrically opposite directions.

The absence of an efficient set is probably the most common cause of the absence of single peaked preference functions in individual preferential choice behavior.

To summarize so far: the individual brings to the decision problem elemental utility functions that satiate

and escalate, is essentially hedonistic, has a bit of rationality in neglecting dominated alternatives, and in general, appears to have everything required for a simple scan or search mechanism to find the optimal choice. However, the set of options from which the individual must choose may not be an efficient set. This means that single peakedness of the decision process is not assured and that can make the decision more difficult. We note in passing, that there is little the individual can do about the options except screen them to eliminate those that are dominated. But if the options are in more than two dimensions, this screening will not insure that they are even totally ordered, much less an efficient set.

Let us now put all this in another light. We recognize that when an individual makes a choice between two or more options, that individual is resolving a conflict between incompatible goals. The individual is pulled two different ways.

Now some conflicts between individuals occur because they want different things and must settle for the same thing, e.g.:

-- a conflict between husband and wife over where the family will go for a summer vacation - the seashore or the mountains?

-- a conflict between tenant and landlord over maintenance and repairs.

-- a conflict between a car owner and an auto mechanic over the quality of the work done.

-- or an employee asks an employer for a raise and wants more than is offered.

In each case the two parties are pulled in opposite directions, but the decision, the choice, must hold for both.

We see a parallel, then, between conflict within individuals because they are torn between incompatible goals (Type I), and conflict between individuals who want different things and must settle for the same thing (Type II).

We will trace this parallel, and see what correspondences there are and where the differences are, and see what advantage we can take of our knowledge about the first to help resolve the second.

Let us take a simple example first.

Transition to Social Conflict

Consider a hypothetical conflict between a husband and wife over number of children, illustrated by Fig.9.

[Insert Fig.9 about here]

Both parties have a single peaked preference over number of children. A has a peak at 1 and has positive preference for 3 but negative preference for 4 or more.

B has increasing positive preference for children up to 4, which is B's ideal, still has positive preference for 5, but does not want 6 or more. The status quo for both is zero children as they have none yet.

There are two more psychological principles we introduce in support of our setting the preference value of the status quo equal to zero for both parties. We assume that individuals, in spite of how they may assess their status quo in any absolute terms, are motivated to improve on the status quo and to avoid worsening it. So positive utility reflects an improvement on the status quo and negative utility a worsening. This zero is not subject to any transformation. Other than this fixed point at zero the utility scale is ordinal with positive and negative preference identified with approach and avoidance tendencies, respectively. We call such a scale a signed ordinal scale (subject to any arbitrary monotone transformation that preserves sign).

Both parties prefer 1 child to none and both prefer 4 children to 5 or more. So only the options from 1 to 4 are the ones over which there is conflict. We refer to them as the viable options. Note that the viable options lie between the two peaks.

Where individuals have preference it is convenient to speak of options as having ambience. Options with positive ambience induce approach processes and those with negative ambience, avoidance processes, adapting Kurt Lewin's terms and insights to our purposes (Lewin, 1935).

We see that both parties have positive preference for 1-3 children, so we call the conflict over 1-3 children an approach/approach conflict. We also see that A has negative and B has positive preference for 4 children and we call that an approach/avoidance conflict.

These purely structural characteristics will be related to the relative difficulty of resolving these conflicts.

We illustrate with Fig.10 the basic difference between Type I and Type II.

[Insert Fig.10 about here]

This figure could represent either a Type I or a Type II conflict. If it were a Type I the two opposing functions are utility functions and would be in one head; if it a were a Type II, the two opposing functions would be the inner branches of two preference functions in different heads.

The fact that the opposing functions are in different heads in a Type II conflict, gives rise to a number of fascinating problems, some of them currently insoluble in a satisfactory manner. For example, a single individual in a Type I decision problem may have little difficulty comparing the utilities of good and bad components and of combining them to his or her own satisfaction and in his or her own best interest. But when these are in different heads, the problems of comparability and combination, raise deep measurement issues and ethical issues, respectively.

These are not problems for the individual trying to satisfy his or her own incompatible goals, but they are problems when two or more people may choose only one option yet seek to satisfy their incompatible goals. So we can see some similarities between Type I and Type II and also some of the differences and the reasons for them.

I called this conflict between husband and wife a simple one because of the a priori structure on the options - they came neatly ordered.

What does one do when they don't come already ordered, like when a husband and wife are trying to choose a new home or a place to go for a vacation?

Edgeworth's Solution for Two-Dimensional Options

Edgeworth, a hundred years ago (Edgeworth, 1881), provided the solution to this problem under certain very limited conditions - the exchange of commodities between two parties - like Labor and Management exchanging work and money.

We illustrate his contribution with Fig. 11, which displays the space of all possible conflicts.

[Insert Fig. 11 about here]

The upper right panel shows the indifference curves of Management, with preference peaking at a lot of work for little money; and the panel at upper left shows the indifference curves of Labor, with preference peaking at little work for a lot of money. The shapes of these indifference curves are a consequence of two assumptions which Edgeworth proposed as two laws: a law of decreasing

utility and a law of increasing labor. These laws, you will recognize, are special cases of our more general principles that good things satiate and bad things escalate. From the point of view of Management, for example, work is a good thing but satiates, and wages are a bad thing and escalate. The point of view of Labor is the reverse.

If we superimpose these two panels we get the one shown in the bottom panel. Each indifference curve of one party is tangent to an indifference curve of the other party. The line drawn through the points of tangency he called the contract curve. He asserted, correctly, that a point of tangency is the optimal contract for each party among all the contracts the other party considered equivalent.

So whatever contract is ultimately arrived at, it should be chosen from among those on the contract curve. Because if a contract not on the contract curve were chosen, there exists one on the curve that is at least as good for both and better for at least one.

Edgeworth's development does not extend readily to complex options - a contract between Labor and Management may involve many things besides hours of work and amount of money, e.g., subsidized food in the cafeteria, safety in the workplace, medical benefits, vacations, seniority, etc. Also, no feasible algorithm was provided for constructing the contract curve.

Generalizing his model overcomes these limitations. We call this more general solution the frontier of preference.

The Frontier of Preference

Each party is assumed to have a preference ordering over the space of available options. The frontier of preference is formed from the conjunction of these preference orders under the following rule: an option x is a member of the frontier if and only if no option y exists such that y is preferred to x by at least one party and at least as good as x for the other party.

We show in Fig. 12 how this works.

[Insert Fig. 12 about here]

Here is the space of all possible options. It has only two dimensions because the coordinates of the options are the ordinal preferences of the two adversaries. A's preference order is the ordinate with the option labelled a indicating A's ideal, and B's preference order is the abscissa with b indicating B's ideal.

The options that survive the screening are connected with a line, which we see passes through axyzb. For example, both parties prefer y to v and that eliminates v from the frontier. Indeed, if y did not exist, v would be on the frontier, and if v, y, and z, all three, did not exist, then w would be on the frontier.

The frontier of preference is a totally ordered set covered by the inner branches of A's and B's preference functions. Preference decreases strictly monotonically for A from a to b and decreases monotonically for B from b to a.

This set of options has the characteristic that the ultimate resolution of the conflict should be an option from this set because any other option would require more concession on the part of one or both parties, and, as this additional concession is unnecessary, it makes it more difficult to reach an agreement.

Let us make this frontier a little more real psychologically. Suppose these two parties, A and B, were sovereign states forming a nuclear agreement. There are at least three dimensions to such an agreement: which systems will the agreement cover, what degree of verification will there be, and when is the agreement to be implemented.

There are at least 100 nuclear systems deployed around the world and the agreement may cover any subset of these. The degree of verification and the date of implementation also have many possible values, so any number of potential agreements (options) may be formulated. Each potential agreement is a portfolio of piecemeal decisions, a mixture of gains and concessions where gains are relative to the status quo and concessions are relative to the ideal.

There is clearly no natural order on such options because they are composed of many attributes in general distribution. But each party may be assumed to have a preference order as a consequence of resolving their respective Type I conflicts; and the conjunction of these orderings into the frontier of preference reduces the space of options to a line as in Fig.12.

Now let us suppose that the option w represents the status quo. We see, in this example, that the status quo is not on the frontier because there is another option preferred to it by both parties. In fact, there are several, v,y, and z. But the status quo always remains an option in that it is a sort of fall back when no agreement that is mutually acceptable can be formulated.

The status quo is in each party's preference order, so it can be projected into the frontier where it serves as a boundary for each party between options with positive and

negative ambience, between approach and avoidance processes. The projections are labelled ipA and ipB in Fig.12, to stand for the initial position of A and B, respectively. All options on the frontier and to the left of ipA have positive ambience for Party A and all options on the frontier and to the right of ipB have positive ambience for B.

Clearly y and z are the only options that have positive ambience for both parties and so either y or z would be an improvement on the status quo in the view of both parties because both stand to gain. The option x would constitute an approach/avoidance conflict because A likes it but B doesn't.

We do not presume to say which option should be chosen. This involves substantive and contextual considerations of unlimited variety and beyond the scope of the structure of conflict. But the important point is that the frontier of preference focuses attention on those options that minimize concession and, correspondingly, maximize gain. The frontier puts a ceiling on concession in the sense that any option chosen that is not on the frontier requires unnecessary concession from one or both parties.

Someone once said a compromise is the shortest distance between two points. The frontier of preference makes this realizable.

It is easy to show that this algorithm converges on the contract curve and generalizes it to any dimensionality and to any level of complexity.

Distance Between Adversaries

Let us go on a little further. It is not uncommon to speak of how far apart two adversaries are in the sense of how difficult it is to bring them to an agreement. These are impressionistic notions, not well-defined, but intuitively attractive. The concepts of approach and avoidance processes, along with the frontier of preference, provide a means of precisely defining and measuring the distance between adversaries and, most importantly, exposing these notions to empirical study.

[Fig.13 One Unit Distance Between Adversaries]

Consider the conflict displayed in Fig.13. Here are two SPF's drawn for clarity and simplicity with straight lines and pointed peaks. A's SPF peaks at the option labelled a on the scale and intersects it at the options labelled 1 and 2. B's peak is at b and intersects the scale at the options labelled 3 and 4. The scale of options, being the frontier of preference, is totally ordered between a and b and the inner branches are strictly monotonically

descending. The order of the intercepts outside the ideal points is irrelevant.

The peaks and intercepts partition the scale of options. The range of viable options is always between the two peaks, and so here the viable options comprise the segment of the scale from a to b, which is intact, and the conflict over these options is an approach/approach conflict. This is a conflict in which the two parties are as close together as possible.

[Insert Fig.14 about here]

Now suppose that B's intercept numbered 3 were one of the viable options between a and b. This would occur if B's preference function decayed sufficiently rapidly over the viable options. As a consequencee, the viable options would be partioned into two segments: one segment, that between 3 and b, would be a set of options over which the conflict is an approach/approach conflict. The other segment, that between a and 3, would be a set of options over which the conflict is an approach/avoidance conflict.

In effect, A and B have moved farther apart, and it would be more difficult to bring them to accept the same option.

These two figures are repeated in the next figure.

[Insert Fig.15 about here]

The viable options are always between a and b, and in the figure on the left this segment is intact as in Figure 13.

To the right of it and below, we have Figure 14, in which the number 3 intercept divides the viable options into two contiguous segments, as we just saw.

Of course if A's inner branch had been the one to decay more rapidly instead of B's, we would have the same separation between the two parties. It would just have interchanged the roles of A and B, as may be seen in Fig. 15.

If the inner branches of the preference functions of both parties dropped off sufficiently rapidly, we would have a third level in the difficulty of resolving Type II conflicts, as shown next in the figure. This third level is one in which the viable options are partitioned into three segnents, a central one that is an approach/approach segment, and a segment on either side that is an approach/avoidance conflict.

Finally, we have the most severe case, a fourth level of distance between adversaries. At this level, the viable options between the two peaks are again divided into three segments, but the decay of preference for both parties is so rapid that the central segment is an avoidance/avoidance conflict and the two adjacent segments are approach/avoidance conflicts with the avoidance process relatively strong.

Kemeny (1959) has shown that the number of pairwise reversals between two orderings satisfies the axioms for a metric, so we see that the range of distances between adversaries in a Type II conflict is from one to four units.

This analysis reveals that the resolution of a conflict can be made easier by changing the status quo, which changes the intercepts; and this may be effective when the ideals of the opponents are resistent and unyielding. So, as the status quo deteriorates, previously undesirable options become more acceptable. In effect, the parties come closer together and the conflict becomes easier to resolve.

Type III Conflict

Now, if one type of social conflict occurs because individuals want different things and must settle for the same thing, then there must logically be a third type of conflict, conflict that occurs between individuals because they want the same thing and must settle for different things. We call this 3rd type, Type III, and it exhausts the domain of conflict.

Here are two extreme cases. Professional sports is one. Both antagonists want to win, to be champion. The other case is that of two countries each seeking hegemony over the same islands.

In each case the parties want the same thing and have to settle for different things. In professional sports the parties are left to settle it themselves. The problem, then, is escalation, so referees are given the authority and the power to enforce rules. In disputes between sovereign states there is no higher authority with power to impose rules, so the danger of escalation is greatly increased.

The process of resolving Type III conflicts is esentially one of a sequence of unilateral actions and reactions to determine a winner, in contrast to Type II which involves a search for a mutually acceptable outcome. There is no mutually acceptable outcome in a Type III conflict. Each party wants to impose its will on the other at most any cost.

We do not have, in Type III, the peaks of two different preference functions, as we do in Type II, to serve as anchors between which we could construct a contract curve, a frontier of preference, which would assure us that whatever option was chosen it would be one of the best.

There is, of course, the danger of escalation in Type II conflicts also, conflicts within a family or between Labor and Management can get pretty violent. But there is a distinction between Types II and III that bears on their susceptibility to escalation.

In Type II the parties have to settle for the same thing because they are parts of an entity, a sense of community or solidarity. There is a bond between them that they seek to preserve. The husband and wife want to preserve their marriage, Labor and Management want to preserve the company and their jobs.

In a Type III conflict there is no entity strong enough to forge a bond that will drive both parties to seek a compromise. If either the husband or wife refuses to compromise, the sense of community or bond, the marriage, is at risk. If Labor and Management can not reach agreement, if, for example, one of them holds to a bottom line that is unacceptable to the other, then the company may dissolve.

In Type III, self-interests dominate mutual interests and the exercise of power dominates the process of persuasion.

The Transformation of Types

This classification of conflict into three types is exhaustive but not mutually exclusive. To a considerable extent the classification of a conflict depends on how it is framed, to adapt Tversky and Kahneman's term ( ), how it is looked at or who looks at it. The conflict between two men courting the same woman is a Type III for the men but for the woman it is a Type I. She may be torn, for example, between security and excitement, two incompatible goals in the choice she faces.

In general one can transform most conflicts from one type to another. A couple getting a divorce and deciding custody of children or division of property is on the knife edge between a Type II and a Type III.

Each may want custody of the children, for example. If left to them to decide, they may well want the same thing and have to settle for different things, in which case, the conflict becomes a Type III and may escalate. Going to court to resolve the conflict transforms it into a Type II if a jury has to deliberate, or a Type I, if a judge decides.

Either transformation, however, means a loss of some sovereignty for each of them because both have to accept the decision of a third party. The court has the power to enforce the decision which resolves the conflict.

In general, to transform a conflict from Type III down into one of the others, tends to make the conflict easier to resolve in the sense of choosing an option, but requires power to impose the solution on the belligerants.

I will close by summarizing these last remarks about social conflict in Fig. 16.

[Insert Fig. 16 about here]

Self-interest drives one from Type II to Type III. Common interest drives one from III to II or I.

In any social conflict, each party has both a self-interest and a common interest, and the relation, the balance between these implicitly implies a scale. Each participant to a conflict can be anywhere on this scale. But if either participant is dominated by self-interest, that is enough to transform the conflict into a Type III. Either Labor or Management can close down a company, it takes the concurrence of both to keep it open. It is in this sense that a Type II is a less stable state.

This analysis of the structure of conflict is also an analysis of the origins of conflict. What answer does it suggest,then, to the question: is war inevitable? It seems very clear that war is not inevitable but that conflict is.

As long as there is some freedom of choice there will always be people who want different things and who will have to settle for the same thing for reasons of mutual dependence. Hence type II conflict is inevitable.

In a world of limited resources there will always be circumstances in which parties will want the same thing and have to settle for different things. Hence Type III conflict is inevitable.

So given a world of limited resources, some freedom of choice, and some mutual dependence, social conflict is inevitable. The problem is to control escalation, and that can only be achieved through some loss of sovereignty by identification with a larger entity that must be preserved. That is the price of freedom from war.

Footnotes

[1] I am deeply indepted to Robert M. Dawes for valuable substantive and editorial suggestions and to George S. Avrunin, without whose collaboration the research on which this paper is based would not have been possible. The research has been supported by National Science Foundation grants.

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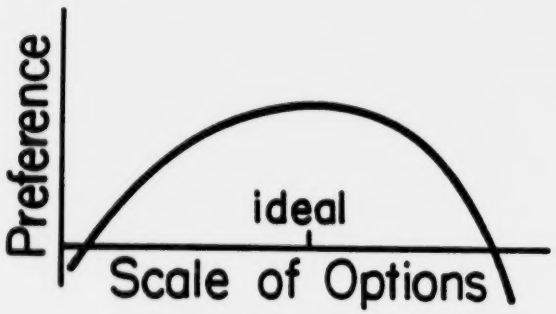
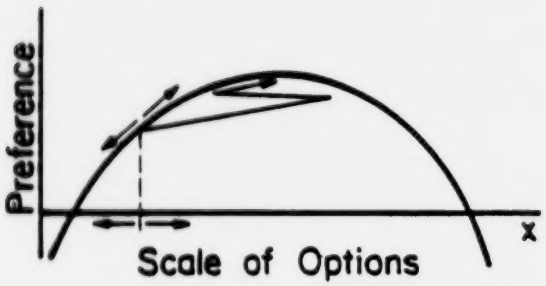
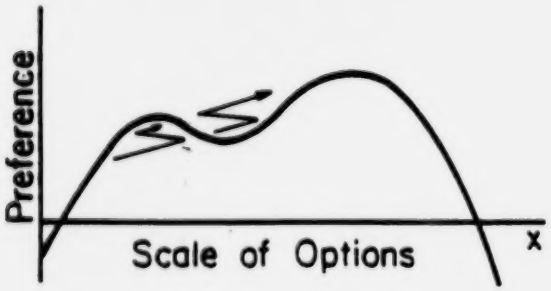
An Example of a Single Peaked Function



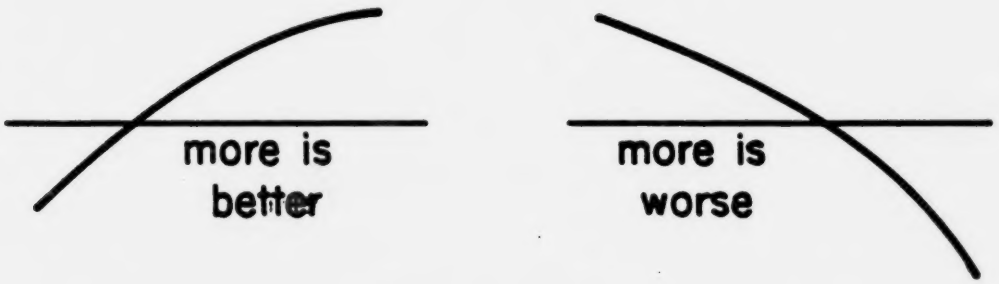
Convergance on Optimality



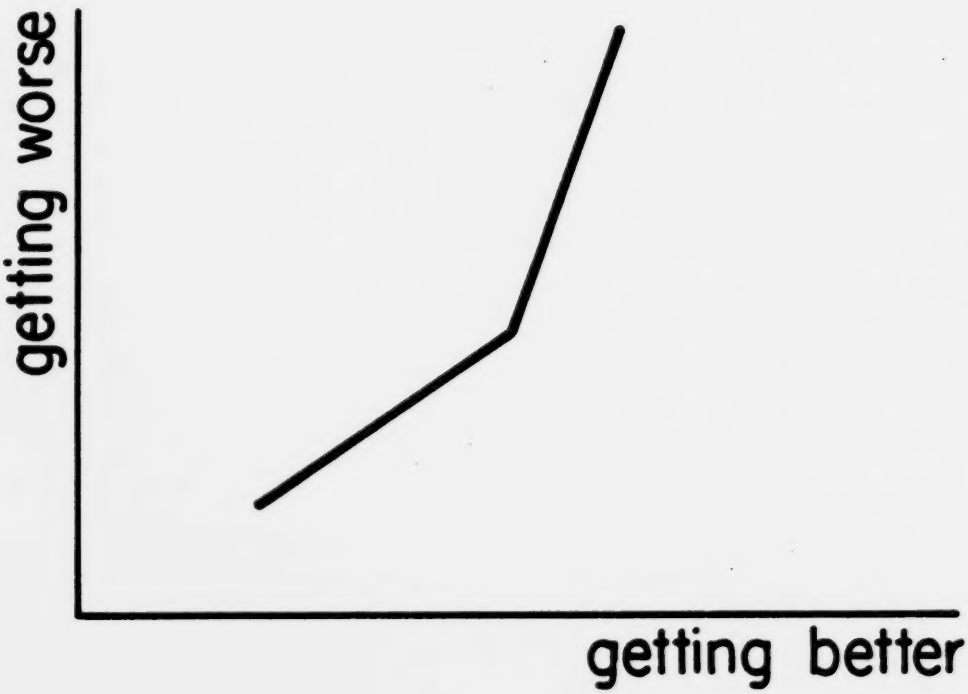
A Multipeaked Preference Function



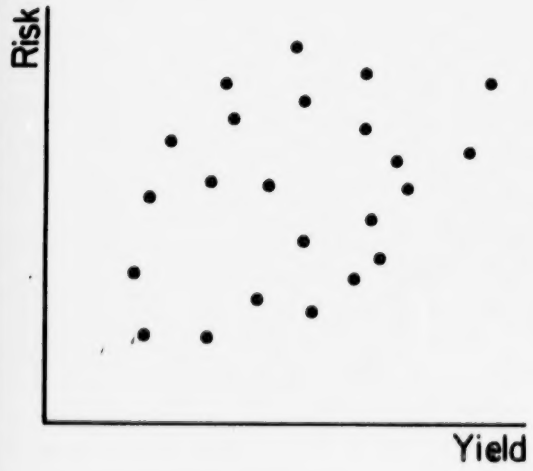
Two Kinds of Elemental Utility Functions



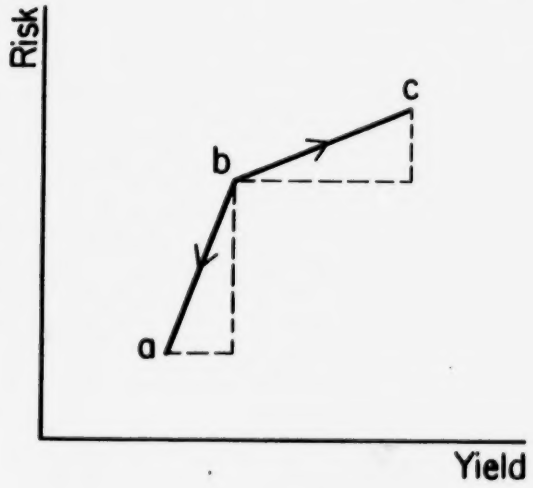
An Efficient Set



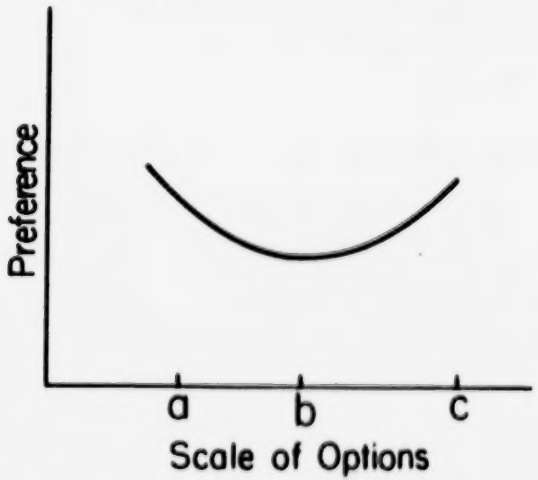
The Domain of Options



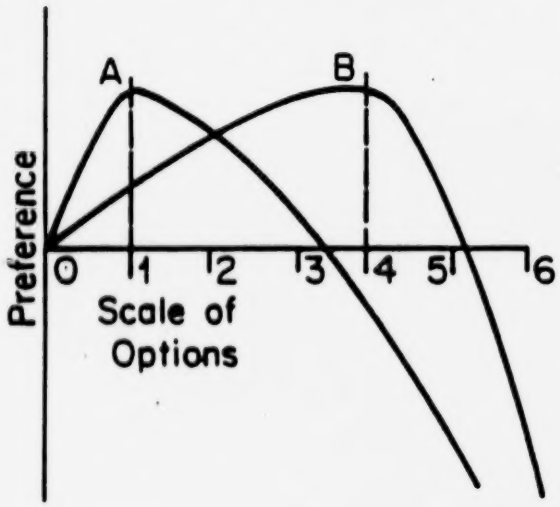
A Pareto Optimal Set but not Efficient



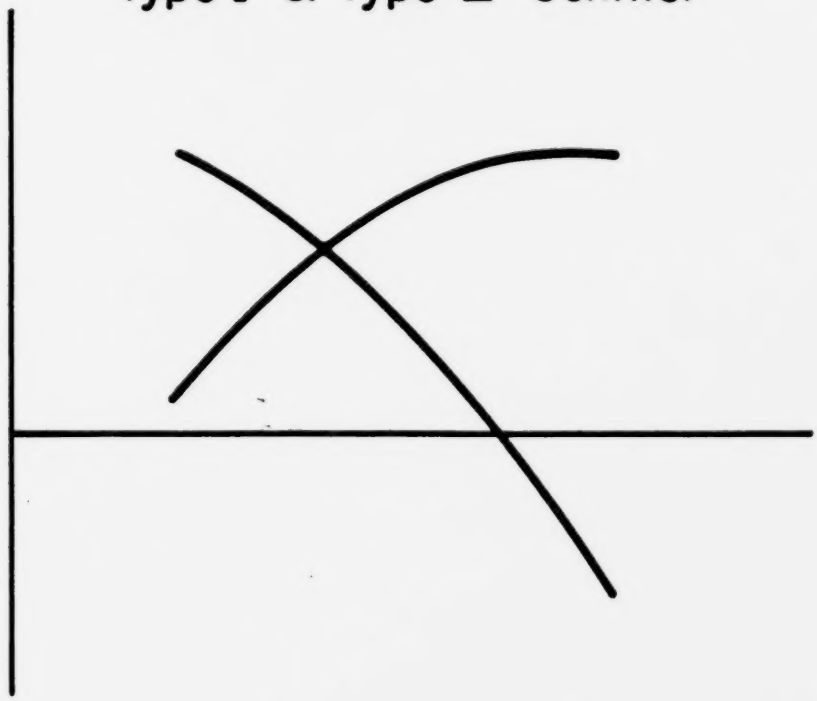
A Dipped Preference Function



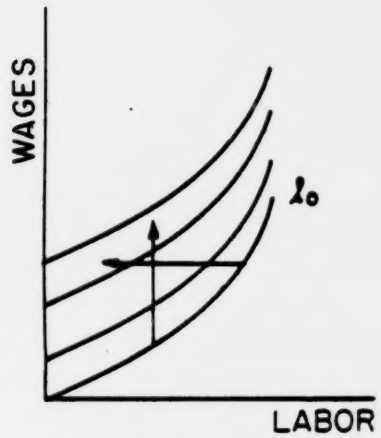
Family Conflict Over Number of Children



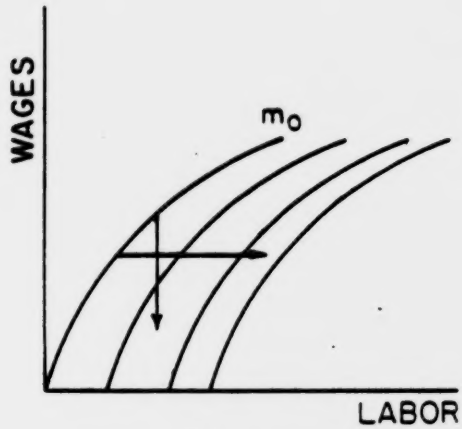
Adversarial Utility Functions in Type I & Type II Conflict



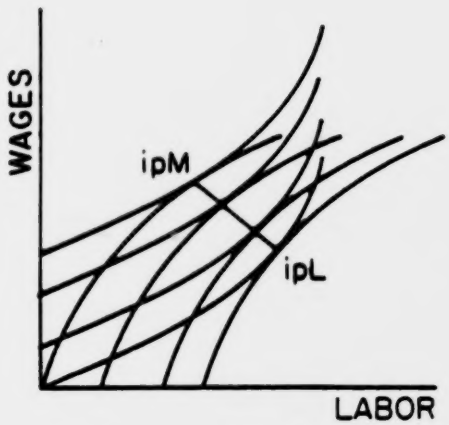
Edgeworth's Economical Calculus



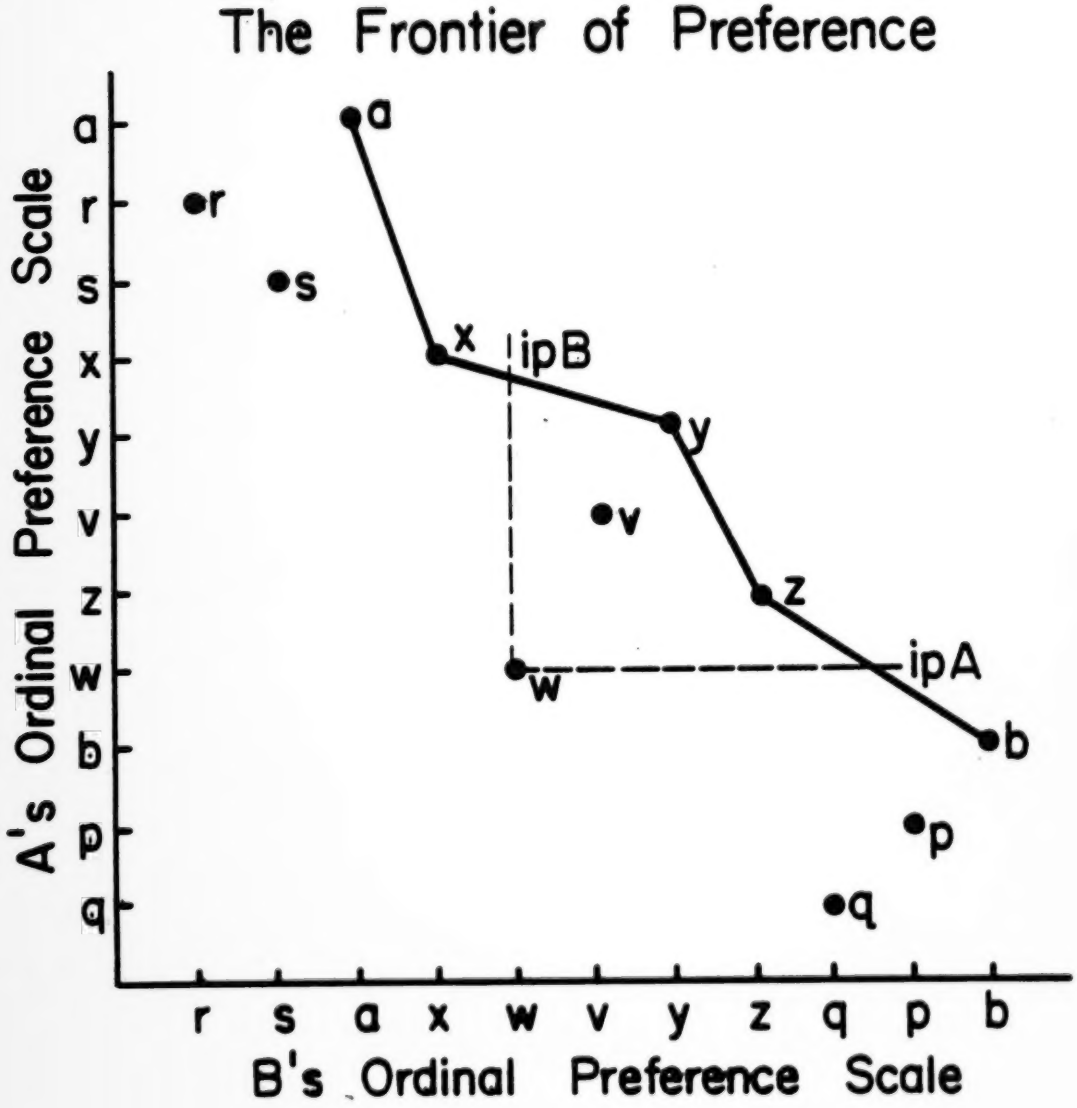
Employee



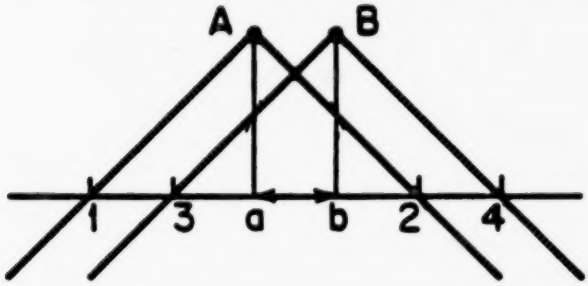
Employer



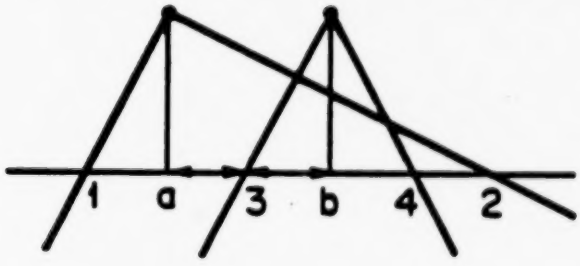
Contract Curve


The Frontier of Preference
A's Ordinal Preference Scale
a
r
s
x
y
v
z
w
b
p
q
a
r
s
x
ipB
y
v
z
ipA
w
b
p
q
r s a x w v y z q p b
B's Ordinal Preference Scale

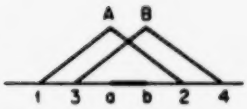
The Minimal Difference Between Adversaries



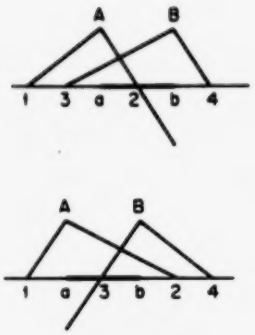
A Second Unit of Distance Between Adversaries



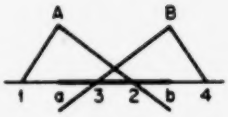
Distance Between Adversaries



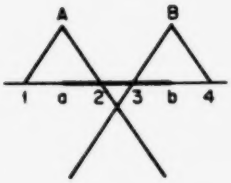
1 unit apart



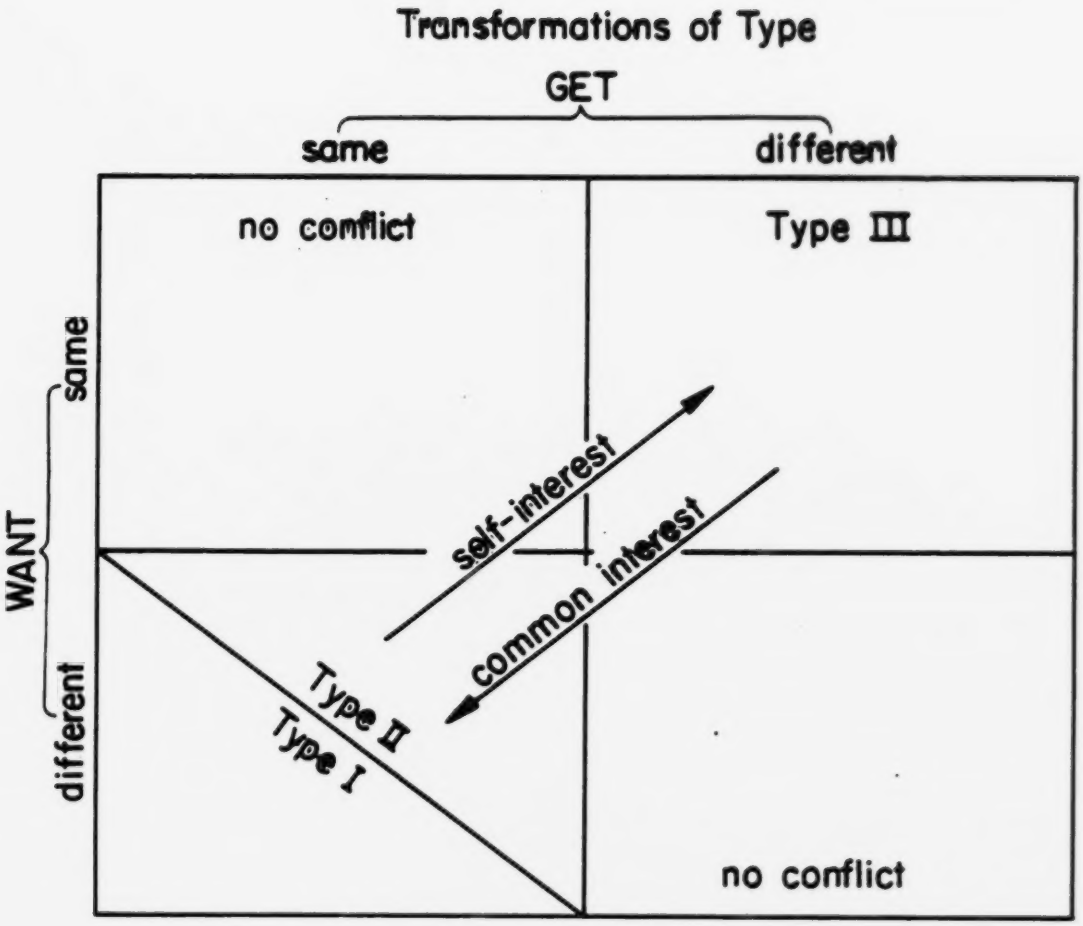
1 reversal
2 units apart



2 reversals
3 units apart



3 reversals
4 units apart


Transformations of Type
GET
same
different
no conflict
Type III
WANT
same
different
self-interest
common interest
Type II
Type I
no conflict